



Title

rdrandinf — Randomization Inference for RD Designs under Local Randomization.

Syntax

```
rdrandinf outvar runvar [if] [in] [, cutoff(#) wl(#) wr(#) statistic(stat_name)
p(#) evall(#) evalr(#) kernel(kerneltype) fuzzy(fuzzy_var [fuzzy_stat])
nulltau(#) d(#) dscale(#) ci(level [tlist]) interfci(#) bernoulli(varname)
reps(#) seed(#) covariates(varlist) obsmin(#) wmin(#) wobs(#) wstep(#)
wmasspoints nwindows(#) rdwstat(stat_name) approximate rdwreps(#) level(#)
plot graph_options(graphopts) obsstep(#) quietly ]
```

Description

rdrandinf implements randomization inference and related methods for regression discontinuity (RD) designs, employing observations in a specified or data-driven selected window around the cutoff where local randomization is assumed to hold. See [Cattaneo, Frandsen and Titiunik \(2015\)](#) and [Cattaneo, Titiunik and Vazquez-Bare \(2017\)](#) for an introduction to this methodology.

A detailed introduction to this command is given in [Cattaneo, Titiunik and Vazquez-Bare \(2016\)](#).

Companion R functions are also available [here](#).

Companion functions are [rdwinselect](#), [rdsensitivity](#) and [rdrbounds](#).

Related Stata and R packages useful for inference in RD designs are described in the following website:

<https://rdpackages.github.io/>

Options

cutoff(#) specifies the RD cutoff for the running variable *runvar*. Default is **cutoff(0)**.

_____ Window selection _____

wl(#) specifies the left limit of the window. Default is the minimum value of the running variable.

wr(#) specifies the right limit of the window. Default is the maximum value of the running variable.

_____ Statistic _____

statistic(stat_name) specifies the statistic to be used. Options are:

diffmeans for difference in means statistic. This is the default option.

ksmirnov for Kolmogorov-Smirnov statistic.

ranksum for Wilcoxon-Mann-Whitney studentized statistic.

all for all three statistics.

The option **ttest** is equivalent to **diffmeans** and included for backward compatibility.

p(#) specifies the order of the polynomial for outcome adjustment model. Default is **p(0)** (constant treatment effect model).

evall(#) specifies the point at the left of the cutoff at which the adjusted outcome is evaluated. Default is the cutoff value.

evalr(#) specifies the point at the right of the cutoff at which the adjusted outcome is evaluated. Default is the cutoff value.

kernel(*kerneltype*) specifies the type of kernel to use as weighting scheme. Allowed kernel types are **uniform** (uniform kernel), **triangular** (triangular kernel) and **epan** (Epanechnikov kernel). Default is **kernel(uniform)**.

fuzzy(*fuzzy_var* [*fuzzy_stat*]) name of the endogenous treatment variable in fuzzy design. Options for statistic in fuzzy designs are:

ar for Anderson-Rubin-type statistic (this is the default option),
tsls for two-stage least squares (TSLs) statistic (only asymptotic approximation).

Inference

nulltau(#) sets the value of the treatment effect under the null hypothesis. Default is **nulltau(0)**.

d(#) effect size for asymptotic power calculation. Default is 0.5 * standard deviation of outcome variable for the control group.

dscale(#) specifies fraction of the standard deviation of the outcome variable for the control group used as alternative hypothesis for asymptotic power calculation. Default is **dscale(.5)**.

ci(*alpha* [*tlist*]) calculates a confidence interval for the treatment effect by test inversion, where *alpha* specifies the significance level (typically 0.05 or 0.01) and *tlist* indicates the grid of treatment effects to be evaluated. This option uses **rdsensitivity** to calculate the confidence interval. See **rdsensitivity** for details. Note: the default *tlist* can be narrow in some cases, which may truncate the confidence interval. We recommend the user to manually set a large enough *tlist*.

interfci(#) sets the significance level (*alpha*) for Rosenbaum's confidence interval under arbitrary interference between units.

bernoulli(*varname*) specifies that the randomization mechanism is Bernoulli trials (instead of fixed margins randomization). The values of the probability of treatment for each unit must be provided in the variable **varname**.

reps(#) specifies the number of replications. Default is **reps(1000)**.

seed(#) sets the seed for the permutation test. With this option, the user can manually set the desired seed, or can enter the value -1 to use the system seed. Default is **seed(666)**.

Options for rdwinselect

When the window around the cutoff is not specified, **rdrandinf** can select the window automatically using the companion command **rdwinselect**. The following options are available:

covariates(*varlist*) specifies the covariates employed by the companion command **rdwinselect**.

obsmin(#) specifies the minimum number of observations above and below the cutoff in the smallest window employed by the companion command **rdwinselect**. Default is **obsmin(10)**.

wmin(#) specifies the smallest window to be used (if **minobs**(#) is not specified) by the companion command **rdwinselect**. Specifying both **wmin**(#) and **obsmin**(#) returns an error.

wobs(#) specifies the number of observations to be added at each side of the cutoff at each step. Default is **wobs(5)**.

wstep(#) specifies the increment in window length (if **obsstep**(#) is not specified) by the companion command **rdwinselect**. Specifying both **wobs**(#) and **wstep**(#) returns an error.

wmasspoints specifies that the running variable is discrete and each masspoint should be used as a window.

nwindows(#) specifies the number of windows to be used by the companion command `rdwinselect`. Default is **nwindows(10)**.

rdwstat(#) specifies the statistic to be used by the companion command `rdwinselect` (see help file for options). Default option is **rdwstat(diffmeans)**.

approximate specifies that covariate balance tests should use a large-sample approximation instead of finite-sample exact randomization inference methods.

rdwreps(#) specifies the number of replications to be used by the companion command `rdwinselect`. Default is **rdwreps(1000)**.

level(#) specifies the minimum accepted value of the p-value from the covariate balance tests to be used by the companion command `rdwinselect`. Default is **level(.15)**.

plot draws a scatter plot of the minimum p-value from the covariate balance test against window length implemented by the companion command `rdwinselect`.

graph_options(graphopts) graph options for plot generated by the companion command `rdwinselect`.

quietly suppress output from the companion command `rdwinselect`.

obsstep(#) specifies the minimum number of observations to be added on each side of the cutoff by the companion command `rdwinselect`. This option is deprecated and only included for backward compatibility.

Example: Cattaneo, Frandsen and Titiunik (2015) Incumbency Data

```

Setup
. use rdlocrand_senate.dta, clear

Randomization inference with user-specified window and default options
. rdrandinf demvoteshfor2 demmv, cutoff(0) wl(-.75) wr(.75)

Randomization inference with all statistics
. rdrandinf demvoteshfor2 demmv, cutoff(0) wl(-.75) wr(.75) stat(all)

Randomization inference with triangular weights
. rdrandinf demvoteshfor2 demmv, cutoff(0) wl(-.75) wr(.75) kernel(triangular)

Randomization inference on the Kolmogorov-Smirnov statistic with rdwinselect
window options
. rdrandinf demvoteshfor2 demmv, cutoff(0) statistic(ksmirnov)
covariates(dopen population demvoteshlag1) wmin(.5) wstep(.125)

Randomization inference with linear adjustment
. rdrandinf demvoteshfor2 demmv, cutoff(0) wl(-.75) wr(.75) p(1)

Randomization inference under Bernoulli trials with .5 probability of treatment
. gen probs=.5
. rdrandinf demvoteshfor2 demmv, cutoff(0) wl(-.75) wr(.75) bernoulli(probs)

Confidence interval under interference
. rdrandinf demvoteshfor2 demmv, cutoff(0) wl(-.75) wr(.75) interfci(.05)

Confidence interval for the treatment effect
. rdrandinf demvoteshfor2 demmv, wl(-.75) wr(.75) ci(.05 3(1)20)

Linear adjustment with effects evaluated at the mean of the running variable
. qui sum demmv if abs(demmv)<=.75 & demmv>=0 & demmv!=. & demvoteshfor2!=.
. local mt=r(mean)
. qui sum demmv if abs(demmv)<=.75 & demmv<0 & demmv!=. & demvoteshfor2!=.
. local mc=r(mean)
. rdrandinf demvoteshfor2 demmv, wl(-.75) wr(.75) p(1) evall('mc') evalr('mt')

```

Saved results

rdrandinf saves the following in **r()**:

Scalars

r(wl)	left end of window used
r(wr)	right end of window used
r(N)	sample size in used window
r(N_left)	sample size in used window to the left of the cutoff
r(N_right)	sample size in used window to the right of the cutoff
r(p)	order of polynomial in adjusted model
r(obs_stat)	observed statistic
r(randpval)	randomization p-value
r(asy_pval)	asymptotic p-value
r(ci_lb)	lower limit of confidence interval (if ci option is specified)
r(ci_ub)	upper limit of confidence interval (if ci option is specified)

Locals

r(seed)	seed used in permutations
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Matrices

r(obs_stat)	matrix of observed statistics (when all is specified)
r(asy_pval)	matrix of asymptotic p-values (when all is specified)
r(p_val)	matrix of p-values (when all is specified)

References

- Cattaneo, M. D., Frandsen, B., and R. Titiunik. 2015. Randomization Inference in the Regression Discontinuity Design: An Application to Party Advantages in the U.S. Senate. *Journal of Causal Inference* 3(1): 1-24.
- Cattaneo, M.D., Titiunik, R. and G. Vazquez-Bare. 2016. Inference in Regression Discontinuity Designs under Local Randomization. *Stata Journal* 16(2): 331-367.
- Cattaneo, M. D., Titiunik, R. and G. Vazquez-Bare. 2017. Comparing Inference Approaches for RD Designs: A Reexamination of the Effect of Head Start on Child Mortality. *Journal of Policy Analysis and Management* 36(3): 643-681.

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